

Vegetation matrix of Gurudongmar Wetland Complex of Northern Sikkim of India

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ABSTRACT

This is an overview of the alpine vegetation of Northern Sikkim reflecting the vegetation composition of the regions. In the context of the climate change, the vegetation matrix documented that plays a pivotal role in glacial ecosystem. The significant places of the regions were studied recording GPS coordinates for the future references.

Keywords: Glacial lake, Gurudongmar wetland complex, Sikkim

1. INTRODUCTION

The glory of the Sikkim biodiversity attracts the naturalists, environmentalist, conversationalist and scientists of the world. At the same time, the State Government is empowering the Sikkim with several policies for the responsible green governance. Natural resources of Sikkim have a gradient of resources from lower tropical altitude to alpine covering cold desert providing national and ecological security at the larger end. In other word, Sikkim is the biodiversity window for the world. Several studies are undertaken in the Himalayan regions of Eastern Himalaya (Cowan and Cowan, 1925; Hara, 1966; Tsarong, 1994; Lucksom, 2007; Stainton, 2007; Polunin and Stainton, 2009; Pradhan, 2010; Kanwal, 2021; Riyaz, 2022) etc.

In view of these, the recorded vegetations of the different alpine altitudes of Gurudongmar Wetland Complex of Northern Sikkim of India were studied and presented.

2. MATERIALS AND METHODS

The vegetation matrixes of the alpine regions of Gurudongmar wetland complex were studied and subsequently collected the specimens for the identification. Referring to the literatures, the specimens were identified and deposited in the herbarium in Sikkim State Forest Herbarium (SSFH), Gangtok.

The ecological studies of alpine vegetation were undertaken setting the sample quadrats. The quadrats' sizes for shrubs and herbs were 25m and 1 m,

respectively. The GPS of the studied location recorded. The attributes of data such as Relative Density (RD), Density (D), Frequency (F), Relative Frequency (RF), Relative Density (RD) and Importance Value Index (IVI) etc were estimated.

3. RESULTS AND DISCUSSION

Gurudongmar and Tso lhamu are two important lakes of North Sikkim which are mostly covered with snow in winter. These were the glacial lakes till 1942. In recent time, the glaciers were reduced to the Khange mountainous regions of wetland complex. Such recession of glacial lakes of high altitudes originate several lakes like Gurudongmar wetland complex, Rathong Glacier region of Dzongri etc.

The major water sources Gurudongmar lake are "Khang-Chen Gyawho" lake, "Who -cho" glacial Lake and "Gyap -Zay Tso" lake. At 5547m, the network of these glacial lakes creates a lake at the base of Khange peak and Dorjee la (pass) is not other than Gurudongmar. Furthermore, these Gurudongmar and Tso lhamu lakes' outlets drain to the river Teesta that is regarded as the lifeline of biodiversity of Sikkim. The latter plays pivotal roles for Sikkim, Bengal and Bangladesh for maintaining vegetation, fauna, sustainability etc. In such context, some basic information with GPS coordinates of Gurudongmar wetland complex provided in Table 1.

Table 1: Study areas: Wetlands of Gurudongmar Wetland Complex				
	Lake/s	Altitude (m)	Latitude	Longitude
1	Gyap -Zay Tso	5547	28:00.44.05 N	88:39.17.11 E
2	Tso lhamu II	5335	27:59.04.15 N	88:49.33.37 E
3	Kangchengyao Tso	5258	28:00.49.84 N	88:42.40.40 E
4	Who -cho	5218	28:00.49.89 N	88:42.18.32 E
5	Gurudongmar lake	5167.56	28:2:5.650 N	88:42:30.419 E
6	Tso lhamu I	5105	28.01.29.35 N	88:45.17.98 E
7	Salakphu Tso	5063.13	27:57:30.63N	88:44.35.73 E
8	Chom Kar Lake	5055	28:2:34.06 N	88:42:0.98 E
9	Chom Juk Lake	4851.23	28:1:36.32 N	88:36:28.59 E
10	Water source (1) of Gurudongmar	5165.88	28:1:8.38 N	88:42:35.33 E
11	Water source (2) of Gurudongmar	5163.33	28:1:8:26 N	88:42:37.58 E
12	Himalayan Marmot habitat	5161	28:2:8.57 N	88:42:39.04 E
14	Salty habitat in wetland area	5157	28: 1:27.0058 N	88:42:52.9636 E
15	Water Sources of Chom Juk Lake	4887	28:1:44:52 N	88:36.46.35 E

Vegetation Matrix of Gurudongmar Wetland Complex

During the study, the vegetation of the different locations was studied (Table 2) and recorded their locations, which are presented here.

Acer caudatum Wall., Habitat : Jackthang; *Acer pectianatum* Wall., Habitat : Yumthang chu bridge to Dombeyang; *Acer stachyophyllum* Hiern., Habitat: Zema I; *Acer sterculiaceum* Wall., Habitat : Gurudongmar Wetland Complex; *Acronema bellum* (C. B Clarke) P. K Muku., Habitat : Lasha Chu; *Arenaria bryophylla* Fernald., Habitat: Giayong to Gurudongmar; *Arenaria ciliolate* Edg. & Hook. f., Habitat: Thangu; *Arenaria debilis* Hook. f. ex Edgew. & Hook. f., Habitat: Gurudongmar; *Arenaria densissima* Wallich ex Edgew., Habitat : Giagong Meadows; *Arenaria melandryiformis* Williams, Habitat : Gurudongmar Wetland Complex; *Arenaria melanodrynoides* Edgew., Habitat : Naku-chu, Muguthang; *Arenaria orbiculata* Royle., Habitat : Lachen to Chetan; Thepla; *Arenaria serphyllifolia* L., Habitat : Thangu; *Aruneus dioicus* (Walt) Fernald ssp *triternatum* (Maxim.) Hara, Habitat: Kissong to Tholung; *Aspidopterys nutans* Hook.f., Habitat :Chungthang to Lachen; *Astragalus confertus* Bunge, Habitat : Gurudongmar Wetland Complex; *Astragalus donianus* DC, Habitat : Thangu; *Astragalus kongrensis* Benth ex Baker, Habitat : Gurudongmar Wetland Complex; *Astragalus sikkimensis* Benth. ex Bunge, Habitat : Gurudongmar Wetland Complex; *Astragalus tenuicaulis* Benth ex Bunge, Habitat : Gurudongmar Wetland Complex; *Astragalus tongolensis* Ulbrich., Habitat : Thangu; *Astragalus xiphocarpus* Benth. ex Bunge., Habitat : Gurudongmar Wetland Complex; *Bupleurum longicaule* Wall. var *dalhouseana* H.f., Habitat : Gurudongmar lake;

Chamaesium novem-jugum (CB Clarke) Norman, Habitat : Thangu; *Circaea alpine* L. ssp *imaicola* (Asch & Mag) Kita., Habitat : Thangu; Damthang; *Clausena willdenovii* W & A , Habitat : Gnathang to Padamchen; *Cortiella depressa* (D. Don) Norman, Habitat : Thangu alpine praires; Yumthang; *Cortiella hookeri* (Cl) Norman, Habitat : Memosamdung to Donkiala; *Deutzia compacta* R. Br., Habitat : Lachen, glacial valley of Yakchey; *Deutzia staminea* Br., Habitat : Lachen, glacial valley of Yakchey; *Drosera pelata* Smith var *lunata* (Buch – Ham ex EC) CB Clarke, Habitat : Lachen; Yackchey, Zakophyak; *Epilobium conspersum* Haussk., Habitat : Jackthang; *Epilobium wallichianum* Houssk., Habitat : Thangu ; *Geranium donianum* Sweet., Habitat : Thangu praires; *Geranium nepalense* Sweet., Habitat : Zema to log bridge; *Geum elatum* Wall., Habitat : Lohnak valley; *Gypsophila cerastoides* D.Don, Habitat : Thangu; *Hedysarum sikkimense* Benth. ex Baker., Habitat : Dongkiola; *Hepatospermum pedunculofum* (Ser) Clarke, Habitat : Lachen to Thangu; *Heracleum sublineare* C.B. Clarke, Habitat : Yumthang to Helipad; *Heracleum candicans* Wallich ex DC., Habitat : Thangu; *Hippuris vulgaris* L., Habitat : Muguthang, marshy places; *Hydrangea aspera* subsp *robusta* (Hook.f. & Thoms.) McClintock, Habitat : Mensithang; *Impatiens jurpia* Ham., Habitat : Thila to Jakthang; *Macdenia himalaica* Hook. f & Thoms., Habitat : Zema II; *Oxytropis lapponica* (Wahlenb.) Gay, Habitat: Gurudongmar Wetland Complex; *Oxytropis microphylla* (Pallas) DC., Habitat : Gurudongmar Wetland Complex; *Oxytropis subphurea* Ledeh., Habitat : Gurudongmar Wetland Complex; *Parnassia cabulica* Planchon ex CB Clarke, Habitat : Thangu- Muguthang; *Parnassia chinensis* Franch., Habitat : Lashar; *Philadelphus tomentosus* Wall. ex. G. Don, Habitat : Lachen; *Pleurospermum apioleus* (Lindl.) Benth. ex C.B.Clarke., Habitat : Gochung to Taling; *Potentilla leonconata* D. Don, Habitat : Lachen –Thangu, Muguthang; *Potentilla peduncularis* D. Don, Habitat : Katao; Jakophyak; *Potentilla sundersiana* Royle, Habitat : Gochong; *Potentilla ambigua* Camb., Habitat : Lachen to Thangu *Potentilla leuconota* D. Don var *pumila* (Hook.f) Hand. Mazz, Habitat : Gaibong to Gurudongmar; *Potentilla macrophylla* D. Don var *macrophylla*, Habitat : Lonak Valley; *Potentilla nivea* L., Habitat : Lonak valley; *Potentilla peduncularis* D. Don, Habitat : Thangu; *Potentilla trullifolia* Hook.f., Habitat : Lachen to Thangu; *Punica granatum* L., Habitat : Gurudongmar Wetland Complex; *Rhodiola coccinea* (Royle) Boriss., Habitat : Lasha chu; *Rhodiola humilis* (Hook. f & T.) Fu, Habitat : Gochung; *Rhodiola amabilis* (Ohba) Ohba, Habitat : Chungthang; *Rhodiola chrysanthemifolia* (Leveille) Fu., Habitat : Chhollamu- Donkiala; Thangu to Lachen; *Rhodiola fastigiata* (Hook.f . & Thoms.) Fu., Habitat : Lonak La; 16500 ft; *Rhodiola fastigiata* (Hook.f & T.) Fu., Habitat : Gurudongmar Wetland Complex; *Rhodiola quadrifida* (Pall) Fls. & Mey., Habitat : Gurudongmar Wetland Complex; *Rhodiola wallichiana* (Hook.) Fu., Habitat : Thangu ; Kissong; *Ribes glaciale* Wall., Habitat : Yumthang to Momesamdung; *Ribes laciniatum* Hook. f & Thoms., Habitat : Yumthang to Memosamdung; *Yuksum Bakhim*; *Ribes orientale* Poir., Habitat : Lonakla, Muguthang; *Rotala indica* (Wild) Kochne., Habitat : Gurudongmar Wetland Complex; *Rubus laciocarpus* Sm., Habitat : Lachung; Kissong;; *Rubus fockeans* Kurz., Habitat : Yumthang chu bridge to Dombayang; *Rubus hypergyrus* Edge. var *niveus* Hara, Habitat : Kishong; *Rubus kumaonensis* Balakr., Habitat : Above Lachen; *Rubus thomsonii* Focke., Habitat : Yumthang chu bridge to Dombayang; *Sabia leptandra* Kk f & Th., Habitat : Lachen to Thangu; *Sanicula elata* Buch. Ham. ex D. Don, Habitat : Zema to log bridge; *Saxifraga strygosa* Wall. ex seringe, Habitat : Lachen and Thangu; *Saxifraga andersonii* Engler, Habitat : Lohnak valley; *Saxifraga assamensis* Wadhawa, Habitat : Gurudongmar Wetland Complex; *Saxifraga brunonis* Wall. ex Ser., Habitat : Gurudongmar Wetland Complex; *Saxifraga cordifera* Hook. f & Thoms., Habitat : Gurudongmar Wetland Complex, Jelega; *Saxifraga indica* (Hook.f & Thoms.) H. Smith., Habitat : Gaigong to Rivulet, Thangu, Gurudongmar; *Saxifraga jacquemontiana* Decne, Habitat : Sebu la; *Saxifraga lepida* H. Smith, Habitat : Gaigong to Gurudongmar lake; *Saxifraga lychnitis* Hook.f & Thoms., Habitat : Phim la, Lashar; *Saxifraga melanocentra* Franch., Habitat : Phalung; Lashar, Sebu la, Lonak Valley; *Saxifraga moorcrotiana* Wall., Habitat : Gurudongmar Wetland Complex; *Saxifraga mucronulata* Royle subsp *mucronulata* Hand.-Mazz., Habitat : Gurudongmar Wetland Complex; *Saxifraga mucronulata* Royle subsp *sikkimensis* (Hulten) Hara, Habitat : Gurudongmar Wetland Complex; *Saxifraga punctulata* Engl., Habitat : Lasha chu, Thangu; *Saxifraga saginoides* Hook.f. & Thom., Habitat : Lasha chu, Sebu la, Dongkiya la, Memosamdung; *Sedum himalense* D. Don, Habitat : Thangu to Goichand, Sipbula ; *Selinium candollei* DC., Habitat : Thangu; *Selinium tenoifolium* Wall ex C.B Clarke, Habitat : Kareng– Chholhamu; *Sibbaldia compacta* (Smith & Cave) Dixit & Pahigrahi, Habitat : North to Dongkiya Lha; *Sibbaldia cuneata* Hornem ex Kuntze, Habitat : Lonak La; *Silene caespitella* Williams, Habitat : Muguthang, Gurudongmar; *Silene gonosperma* (Rupr.) Bocqu. subsp *himalayensis* (Ruhpr.) Bouquet., Habitat : Thangu; *Silene strachey* Edg., Habitat : Lachen; *Skimmia arborescens* Anders. ex Gamble, Habitat : Gurudongmar Wetland Complex; *Skimmia laureola* (DC) Sieb. & Zucc., Habitat : Lachen to Thangu ; *Sorbus prattii* Koehne, Habitat : Near Yondi Gewgong; *Sorbus prattii* Koehne, Habitat : Near Yondi Gewgong; *Spiraea canascens* D. Don, Habitat : Lachen; *Spiraea alpina* Pallas , Habitat : Muguthang; *Spiraea arcauta* Hook.f , Habitat : Thangu; Kissong; *Spiraea micrantha* Hook.fil., Habitat : Lachen; *Spiraea tibetica* Yu & Lu, Habitat : Lohnak valley; *Spiraea zabeliana* Schn., Habitat : Thila to Jakthang; *Stellaria decumbens* Edgew., Habitat : Gurudongmar Wetland Complex; *Stellaria patens* D. Don, Habitat : Zokopyak- Tary kola; *Stellaria sikkimensis* Hook. f. ex Edgew. & Hook. f, Habitat : Lachen to Log bridge; *Tordylopsis brunonis* DC., Habitat : Thangu to Gochung, Lashar; *Ulex europaeus* L., Habitat : Lachung; *Zanthoxylum armatum* DC., Habitat : Lachung etc.

Table 2 : Vegetation Structural characterization of Gurudongmar Wetland Complex
(Relative Density- RD; Density- D; Frequency - F; Relative Frequency- RF; Relative Density- RD and Importance Value Index- IVI)

Plant name/s	D	RD	F	RF	RD	IVI
<i>Aconogonum alpinum</i> (All.) Schur	2.5	22.32	5	8.47	7.25	38.04
<i>Androsace sempervivoides</i> Jacquem. ex Duby	2.3	20.54	4.6	7.79	5.6	33.93
<i>Arenaria festucoides</i> Benth.	2.7	24.11	5.4	9.15	8.5	41.75
<i>Berberis angulosa</i> Wall. ex Hook.f. & Thomson	1.2	10.71	2.4	4.06	3.75	18.53
<i>Caltha palustris</i> L.	1.4	12.50	3.5	5.93	2.8	21.23
<i>Cassiope fastigiata</i> (Wall.) D. Don	4.5	40.18	9	15.25	6.7	62.13
<i>Codonopsis clematidea</i> (Shrenk.) C. B. Clarke	2.3	20.54	3.83	6.49	5.55	32.58
<i>Cordylis impatiens</i> (Pall.) Fisch.	2.3	20.54	2.87	4.87	6.7	32.10
<i>Cortiella hookeri</i> (Clarke) Norman	0.5	4.46	2.5	4.23	2	10.70
<i>Corydalis meifolia</i> Wall.	2.4	21.43	4.8	8.13	7.25	36.81
<i>Crementhodium nepalense</i> Kitam	1.9	16.96	4.75	8.05	3.35	28.36
<i>Cyananthus lobatus</i> Wall. ex Benth.	2.5	22.32	5	8.47	4.5	35.29
<i>Delphinium caeruleum</i> Jacq.	1.2	10.71	2.4	4.06	7.25	22.032
<i>Elsholtzia eriostachya</i> Benth.	3.4	30.36	6.8	11.52	8.5	50.38
<i>Fritillaria roylei</i> Hook.	0.8	7.14	1.6	2.71	1.7	11.55
<i>Gentiana capitata</i> Buch.-Ham. ex D. Don	1.4	12.50	2.8	4.74	5.95	23.19
<i>Gentiana algida</i> Pall.	1.5	13.39	3	5.08	7.8	26.27
<i>Gentianella urnigera</i> Aitken & Long	2.3	20.54	4.6	7.796	7.25	35.58
<i>Jurinea dolomiaea</i> Boiss.	3.3	29.46	6.6	11.18	8.35	49.00
<i>Lepidium apetalum</i> Wild.	1.1	9.82	3.66	6.21	1.7	17.73
<i>Meconopsis aculeata</i> Royle	0.8	7.14	1.6	2.71	3.9	13.75
<i>Meconopsis discigera</i> Prain.	0.6	5.36	1.2	2.03	2.25	9.64
<i>Nardostachys jatamansi</i> DC.	15	133.93	15	25.42	35	194.35
<i>Oreosolen wattii</i> Hook. f	1.6	14.29	3.2	5.42	3.4	23.10
<i>Oxyria digyna</i> (L.) Hill.	0.8	7.14	1.6	2.71	2.8	12.65
<i>Oxytropis lapponica</i> (Wahl) Gay	0.5	4.46	1	1.69	2.15	8.30
<i>Pedicularis longiflora</i> Rudolph.	6.5	58.04	13	22.03	9.95	90.01
<i>Pedicularis oederi</i> Vahl.	6.5	58.04	13	22.03	7.8	87.86
<i>Pedicularis punctata</i> Decne.	5.6	50.00	11.2	18.98	9.5	78.48
<i>Pedicularis rhinanthoides</i> Schrenk. ex Fischer & Meyer	5.5	49.11	11	18.64	7.2	74.95
<i>Peduncularis bicornuta</i> Klotzsch.	2.3	20.54	3.83	6.491	6.05	33.08
<i>Pterocephalus hookeri</i> (Clarke) Hook.	1.2	10.71	2.4	4.06	7.25	22.03
<i>Ranunculus pulchellus</i> C. A Meyer	5.5	49.11	11	18.64	5.55	73.30
<i>Rhodiola humilis</i> (Hook.f et Thoms.) Fu	1.9	16.96	3.8	6.44	5.95	29.35

<i>Saussurea obvallata</i> (DC.) Edgew	4	35.71	8	13.55	10	59.27
<i>Saxifraga mucronulata</i> Royle	0.8	7.14	1.6	2.71	3.35	13.20
<i>Silene nigrescens</i> (Edgew.) Majumder	1.5	13.39	3	5.08	7.95	26.42
<i>Swertia hookeri</i> C. B Clarke	1.3	11.61	4.33	7.34	2.8	21.75
<i>Taraxacum officinale</i> (L) Weber ex F.H. Wigg.	1.1	9.82	3.66	6.21	3	19.03
<i>Thermopsis barbata</i> Royle	1.4	12.50	7	11.86	2.75	27.11

Besides these, the additional information of medicinal values were also recorded, which are presented here. (Abbreviations: SN: Scientific name; U: Uses. P: Plant part in use)

1. SN: *Aconogonum alpinum* (All.) Schur. U: Dysentery, colon treatment. P: Root.
2. SN: *Androsace sempervivoides* Jacquem. ex Duby. U: Dropsy, diuretic, fever. U: P: Leaves, stem, flowers and fruits.
3. SN: *Arenaria festucoides* Benth. U: Expectorant, mucus formation. U: Aerial parts.
4. SN: *Berberis angulosa* Hook. f. U: Conjunctivitis treating urinary tract infection, heal sores, skin infection. P: Flower, fruit, root.
5. SN: *Caltha palustris* L. U: Healing fractured bones, hemorrhage, headache. P: Leaves, flower, stem, seeds.
6. SN: *Cassiope fastigiata* (Wall.) D. Don. U: Antipyretic, fever. P: Entire aerial part.
7. SN: *Codonopsis clematidea* (Shrenk.) Clarke. U: Arthritis, leprosy, Treating tear ligament. P: Entire plant.
8. SN: *Cordylis impatiens* (Pall.) Fisch. U: Blood purity, liver treatment. P: Entire plant.
9. SN: *Cortiella hookeri* (C.B Clarke) Norman. U: Skin, warts, abdominal spasms, healing bone fractures. P: Entire plant.
10. SN: *Corydalis meifolia* Wall. U: Controlling infectious viral fever. P: Aerial parts.
11. SN: *Crementhodium nepalense* Kitam. U: Headaches, gallbladder treatment. P: Leaves, stem, flower and seeds.
12. SN: *Cyananthus lobatus* Wall.ex Benth. U: Treating bile issue. P: Aerial parts.
13. SN: *Delphinium caeruleum* Jacquemont. U: Snake bites, common colds, fever as a result of liver problems. P: Leaves, stems, flowers and seeds.
14. SN: *Elsholtzia eriostachya* Benth. U: Remedies for phlegm, abscess and ringworm. P: Aerial parts.
15. SN: *Fritillaria roylei* Hook. U: Healing fractured bone, menstruation problem. P: Roots.
16. SN: *Gentiana capitata* Buch.- Hook. ex D. Don. U: Gastritis problems, fever. P: Aerial part.
17. SN: *Gentiana algida* Pall. U: Treating infections of lungs and throat; coughing and excessive mucus formation. P: Aerial parts.
18. SN: *Gentianella urnigera* Aitken & Long. U: Severe fever. P: Aerial parts.
19. SN: *Jurinea dolomiaei* Boiss. U: Cancer, rejuvenates body strength. P: Roots, flowers and seeds.
20. SN: *Lepidium apetalum* Wild. U: Healing bone, platelet regeneration. P: Entire plant.
21. SN: *Meconopsis discigera* Prain. U: Lung fever, tonsillitis, oedema. P: Aerial parts.
22. SN: *Meconopsis aculeate* Royle. U: Fractured bone, bone fever, strengthen bone and cartilages. P: Entire plant.
23. SN: *Oreosolen wattii* Hookf. U: Treating against worms, parasites, gastritis, weak bone healing, fractured bones. P: Entire plant.
24. SN: *Oxyria digyna* (L) Hill. U: Smallpox, fever. P: Aerial part.
25. SN: *Oxytropis lapponica* (Wahlenberg) Gay. U: Oedema, dropsy. P: Roots, leaves, stem, flower and seeds.
26. SN: *Pedicularis longiflora* Rudolph. U: To increase sperm count. P: Aerial parts.
27. SN: *Pedicularis oederi* Vahl. U: **against** constipation, dysuria, breathlessness, infection of the bone and marrow, weakness. P: Stems, leaves, flower, seeds.
28. SN: *Pedicularis punctata* Decne. U: Gastro-intestinal diseases, nervous disorders, against cancerous growth. P: Flowers.
29. SN: *Pedicularis rhinanthoides* Schrenk ex Fischer & C. A Meyer. U: gastro-intestinal problems, healing chronic sores. P: Flowers.
30. SN: *Pedicularis bicornuta* Klotzsch. U: Remedies for water retention of body. P: Entire plant.
31. SN: *Pleurospermum candolle* (DC.) C. B. Clarke. U: Against food poisoning, menstruation problems. P: Entire plant.
32. SN: *Ptercephalus hookeri* (C. B. Clarke) Hock. U: Pulmonary treatment, swelling of gland. P: Entire plant.
33. SN: *Ranunculus pulchellus* C. A. Meyer. U: Digestion, dropsy, tumors. P: Aerial parts.
34. SN: *Rhodiola humilis* (Hook. & Thoms.) Fu. U: Rejuvenates weak lungs, skin diseases, common cold. P: Roots.
35. SN: *Saussurea obvallata* (Candolle) Sch. U: Fever due to neurological disorder, blood purity; restoring neurohormonal activation, treating vascular diseases. P: Entire plant.
36. SN: *Saxifraga mucronulata* Royle. U: Pulmonary edema. P: Entire plants.
37. SN: *Silene nigrescens* (Edgew.) Majumdar. U: Against deafness, nasal blockage, severe constipation. P: Roots.
38. SN: *Swertia hookeri* C. B Clarke. U: against neurological disorders, colitis, skin infection. P: Root.

39. **SN:** *Taraxacum officinale* Weber. **U:** Bone and fever. **P:** Entire plant.

40. **SN:** *Thermopsis barbata* Royle. **U:** Hypertension, flowers and leaves for rabies, bilious fever. **P:** Entire plant.

4. CONCLUSION

The policies of the Sikkim for the environment and conservation along with effective environment protecting measures are paramount however the effective measures with the participatory scientific approach would be appropriate for the resilience of climate change. Furthermore, the populations of high valued medicinal plants may be enhanced improving reformative plan and scientific intervention.

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Ethical approval

Vegetation composition from Northern Sikkim was observed in the study. The ethical guidelines for plants & plant materials are followed in the study for sample collection & identification.

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Conflicts of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

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